Some measurements in chemistry:

1 g of hydrogen =

602,000,000,000,000,000,000,000 atoms

6.02×10^{23} atoms

mass of a gold atom =

0.000 000 000 000 000 000 000 327 g

3.27×10^{-22} g

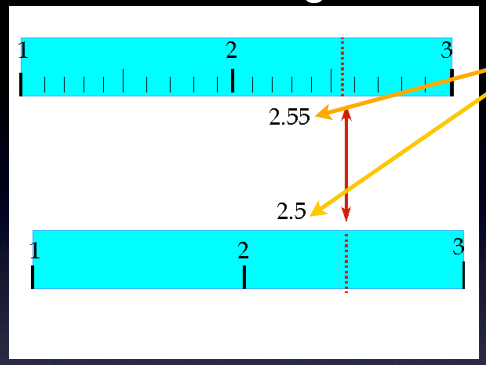
diameter of proton: 1×10^{-15}m

diameter of neutron: 2.2×10^{-15}m

diameter of an aluminum nucleus: 7.2×10^{-15}m

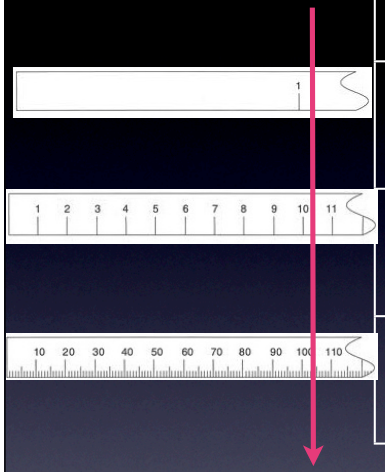
diameter of a gold nucleus: 1.4×10^{-14}m $= 14 \times 10^{-15}$

A measurement consists of all read digits plus one estimated digit.



The numbers in a measurement are called SIGNIFICANT FIGURES "sig figs"

The number of sig figs in a measurement is dependent on the precision of the measuring instrument.



	length	width	area
ruler A	12	8	
ruler B	12.7	7.6	
ruler C	12.70	7.61	

As the precision of the instrument increases, the number of sig figs increases

1948 Summer Olympics

London, United Kingdom
Track & Field

Explain the difference in sig figs between the 1948 and 2000 Olympic track and field times.

Click on **Country** to view all medals for this country during this Olympics
Click on **Athlete** to view all medals for this athlete

Event	Athlete	Country	Result	Medal
100m Men	Harrison Dillard	USA	10.3	GOLD
	Barney Ewell	USA	10.4	SILVER
	Lloyd LaBeach	PAN	10.4	BRONZE
200m Men	Melvin Patton	USA	21.1	GOLD
	Barney Ewell	USA	21.1	SILVER
	Lloyd LaBeach	PAN	21.2	BRONZE
400m Men	Arthur Wint	JAM	46.2	GOLD

2000 Summer Olympics

Sydney, Australia
Track & Field

Click on **Country** to view all medals for this country during this Olympics
Click on **Athlete** to view all medals for this athlete

Event	Athlete	Country	Result	Medal
100m Men	Maurice Greene	USA	9.87	GOLD
	Ato Boldon	TRI	9.99	SILVER
	Obadele Thompson	BAR	10.04	BRONZE
200m Men	Konstantinos Kenteris	GRE	20.09	GOLD
	Darren Campbell	GBR	20.14	SILVER
	Ato Boldon	TRI	20.20	BRONZE
400m Men	Michael Johnson	USA	43.84	GOLD
	Alvin Harrison	USA	44.40	SILVER

Why determine significant figures?

Most numbers in science come from measurements.

Only the numbers that are meaningful (significant) are recorded.

3 basics for determining if a number is significant:

1. Non-zero digits are always significant. 72.564 = 5 sig figs

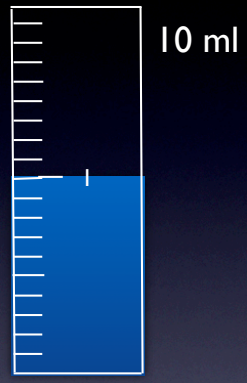
2 . Any zeros between two nonzeros are significant.

12,013.4 = 6 sig figs

3. A final zero or trailing zeros in the DECIMAL PORTION ONLY are significant. 0.0035700 = 5 sig figs

500 = 1 sig fig 500.00 = 5 sig figs

If you measured 1 ml of water in a 10 ml, 25 ml, and 100 ml graduated cylinder, how would you record the measurements?



10 ml

1.00 ml

3 sig figs

25 ml

1.0 ml

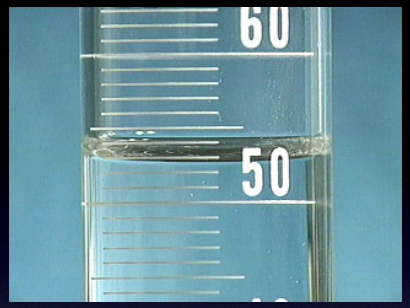
2 sig figs

100 ml

1.0 ml

2 sig figs

100 ml

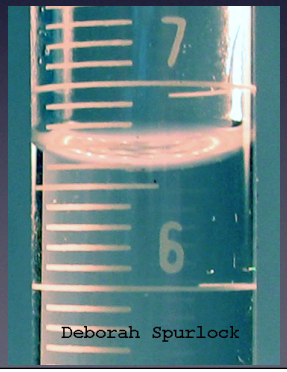


52.8 ml

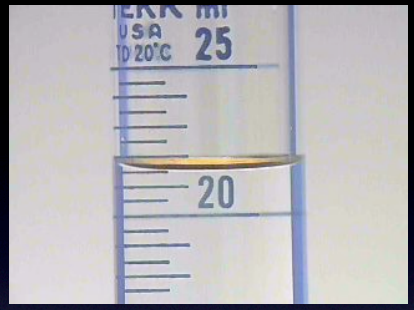
read the tens
and ones, estimate the tenths

The precision
of the instrument
affects the number
of sig figs!

10 ml



25 ml



21.5 ml

read the tens
and ones, estimate the tenths

6.60 ml

read the tens, ones, and tenths,
estimate the hundredths

Multiplying and dividing measurements with sig figs

Round to the least number of sig figs used in the calculation.

Example: $12 \text{ cm} \times 8 \text{ cm} = 96 \text{ cm}^2$

round answer to 1 sig fig

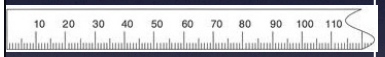
2 sig figs

1 sig fig

so, $12 \text{ cm} \times 8 \text{ cm} = 100 \text{ cm}^2$

Now, we know 12 x 8 does not equal 100, BUT.....

If one of my measurements had only 1 sig fig, then I can only state my answer with certainty to 1 sig fig!

	length	width	area
	ruler A	2 sig figs 12	1 sig fig 8	1 sig fig 100
	ruler B	3 sig figs 12.7	2 sig figs 7.6	2 sig figs 97
	ruler C	4 sig figs 12.70	3 sig figs 7.61	3 sig figs 96.6